

The FY 2003 Budget Request for the Office of Nuclear Energy, Science and Technology

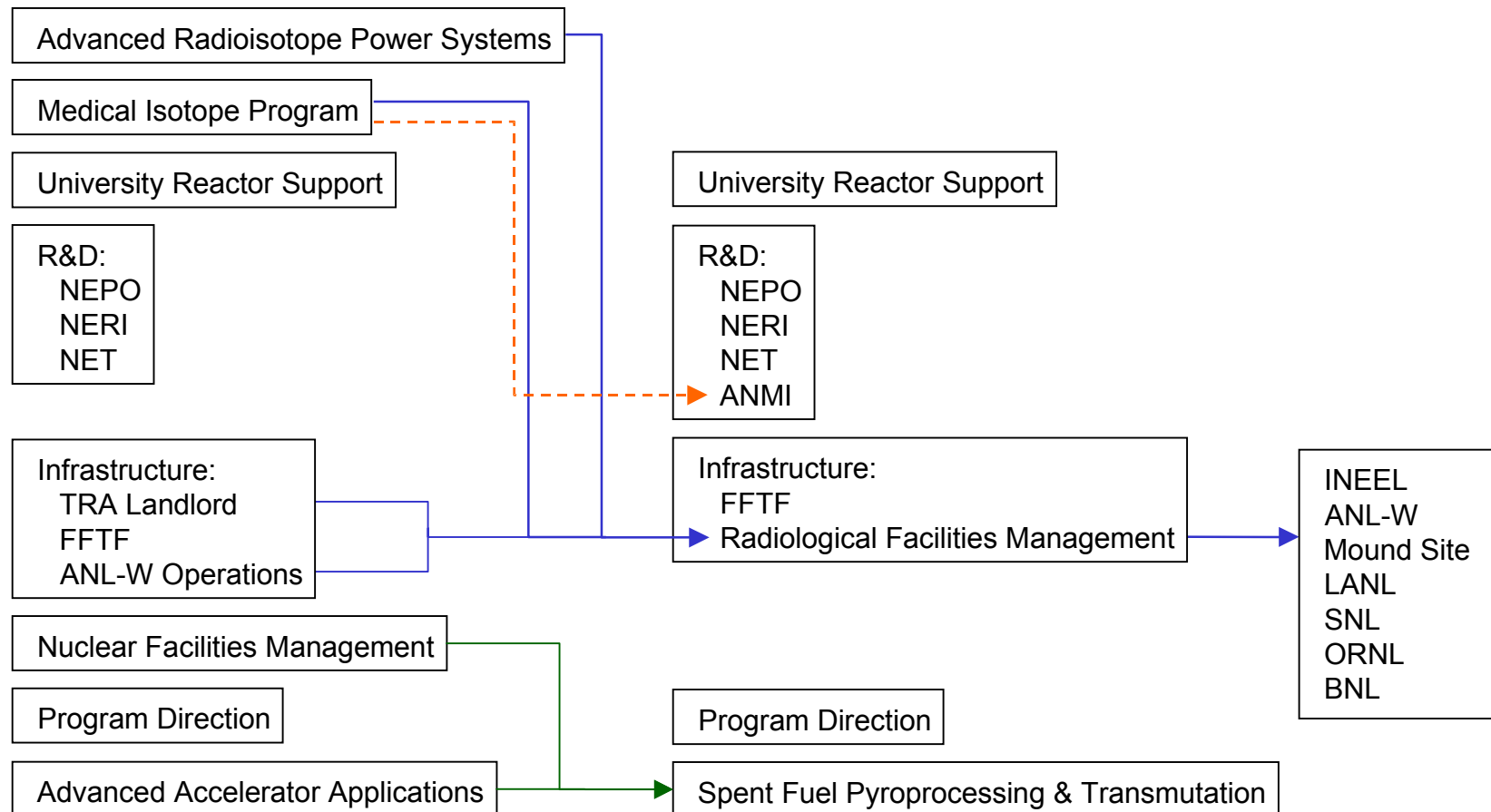




Office of Nuclear Energy, Science and Technology Budget Structure

CURRENT STRUCTURE

PROPOSED STRUCTURE





FY 2003 Nuclear Energy, Science and Technology Budget

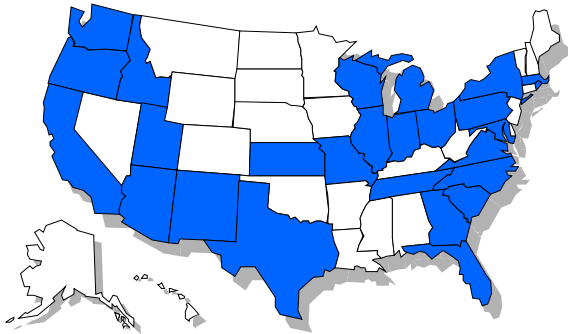
(\$ in Thousands)

| <u>Program</u> | <u>FY 2001 Comp. Approp.</u> | <u>FY 2002 Comp. Approp.</u> | <u>FY 2003 Request</u> |
|---|---|---|-----------------------------------|
| University Reactor Support | \$ 11,974 | \$ 17,500 | \$ 17,500 |
| Research & Development: | | | |
| Nuclear Energy Plant Optimization | 4,857 | 6,500 | 0 |
| Nuclear Energy Research Initiative | 33,903 | 32,000 | 25,000 |
| Nuclear Energy Technologies | | | |
| -Nuclear Power 2010 | 3,000 | 8,000 | 38,500 |
| -Generation IV | 4,483 | 4,000 | 8,000 |
| ANMI | <u>2,500</u> | <u>2,500</u> | <u>0</u> |
| <i>Subtotal, R&D</i> | <i>48,743</i> | <i>53,000</i> | <i>71,500</i> |
| Infrastructure: | | | |
| FFTF | 38,439 | 36,439 | 36,100 |
| Radiological Facilities Management | <u>88,284</u> | <u>86,682</u> | <u>83,038</u> |
| <i>Subtotal, Infrastructure</i> | <i>126,723</i> | <i>123,121</i> | <i>119,138</i> |
| Spent Fuel Pyroprocessing & Transmutation | 68,698 | 77,250 | 18,221 |
| Program Direction | 23,839 | 23,875 | 24,300 |
| Offset from Revenues/Use of Prior Year | <u>-2,872</u> | <u>-818</u> | <u>0</u> |
| TOTAL | \$ 277,105 | \$ 293,928 | \$ 250,659 |



Supporting U.S. Nuclear Technology Education

States With
Participating
Universities



Program Participants

Clemson University
Cornell University
Georgia Institute of Technology
Howard University*
Idaho State University
Kansas State University
Massachusetts Institute of Technology
Morgan State University*
New Mexico State University**
North Carolina State University
North Carolina A&T State University*
Ohio State University
Oregon State University
Pennsylvania State University
Prairie View A&M University

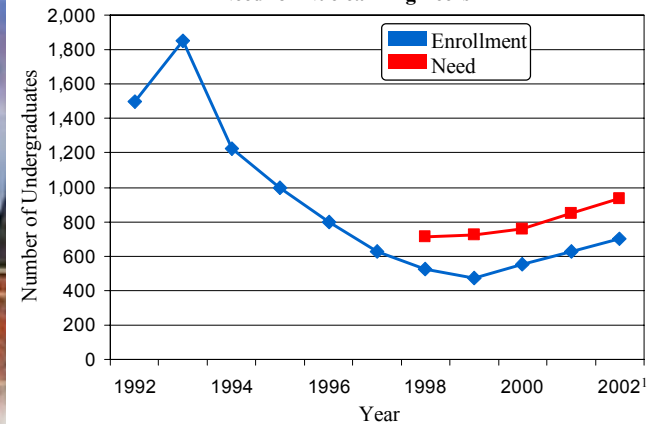
Purdue University
Reed College
Rensselaer Polytechnic Institute
Rhode Island Nuclear Science Center
South Carolina State University*
Tennessee State University*
Texas A&M-Kingsville
Texas A&M University
Tuskegee Institute*
University of Alaska-Anchorage
University of Arizona
University of California-Berkeley
University of Cincinnati
University of Florida

University of Illinois
University of Maryland
University of Massachusetts-Lowell
University of Michigan
University of Missouri-Columbia
University of Missouri-Rolla
University of New Mexico**
University of Tennessee
University of Texas
University of Utah
University of Virginia
University of Wisconsin
Washington State University
Worcester Polytechnic Institute

*U.S. Historically Black Colleges and Universities; **Hispanic Serving Institution



Need for Nuclear Engineers



¹ Projected enrollment/need





University Reactor Fuel Assistance and Support

Program Goal: Support the U.S. nuclear technology education infrastructure in the production of highly trained nuclear engineers and scientists to support the Nation's energy, environmental, health care, and national security needs.

Budget Summary

\$ in millions

| <u>Program Element</u> | <u>FY 2002</u> | <u>FY 2003</u> |
|--|----------------|----------------|
| University Nuclear Infrastructure | 8.0 | 8.0 |
| Matching Grants | 1.2 | 1.2 |
| Fellowship/Scholarships | 1.8 | 1.8 |
| NEER | 5.6 | 5.6 |
| Nuclear Engineering Education Support | 0.6 | 0.6 |
| Radiochemistry Awards | <u>0.3</u> | <u>0.3</u> |
| Total | \$ 17.5 | \$ 17.5 |

FY 2003 Planned Accomplishments

- Continue Innovations in Nuclear Infrastructure and Education awards from FY 2002.
- Provide fresh fuel to and ship spent fuel from all university research reactors requiring these services.
- Award approximately 5 new NEER grants.
- Award 24 fellowships to outstanding nuclear engineering M.S. and Ph.D. students.
- Fund upgrades and improvements at approximately 23 research reactors.
- Continue reactor sharing with up to 28 institutions having university research reactors.
- Award approximately 55 scholarships to outstanding undergraduates.
- Partner with industry to provide 25 or more matching grant awards.



Nuclear Energy Plant Optimization (NEPO)

Program Goal: Resolve critical issues related to long-term plant aging, and develop advanced technologies to improve plant reliability, availability, and productivity to ensure that current plants can operate up to and beyond their initial license period.

Budget Summary

\$ in millions

| <u>Program Element</u> | <u>FY 2002</u> | <u>FY 2003</u> |
|--------------------------------------|----------------|----------------|
| NEPO | 5.9 | 0.0 |
| U.S. Conversion Viability Assistance | 0.4 | 0.0 |
| SBIR | <u>0.2</u> | <u>0.0</u> |
| Total | \$ 6.5 | \$ 0.0 |

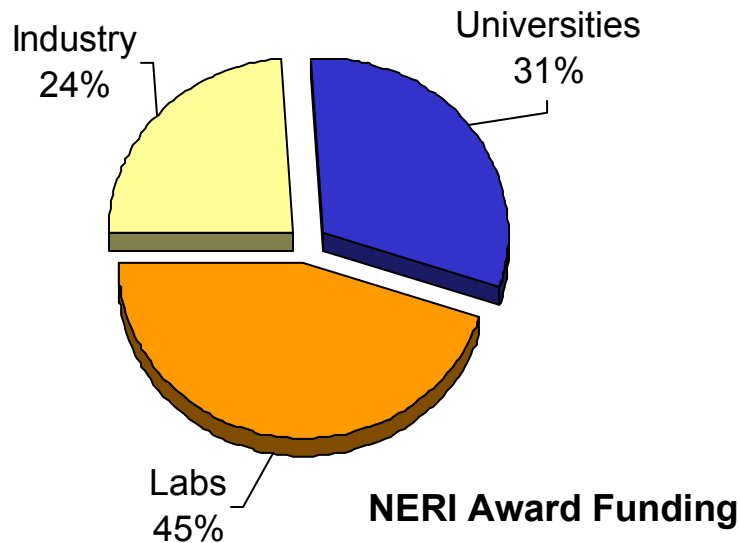
FY 2003 Planned Accomplishments

- R&D activities on approximately 11 projects initiated in prior years, will be completed utilizing prior year funds.



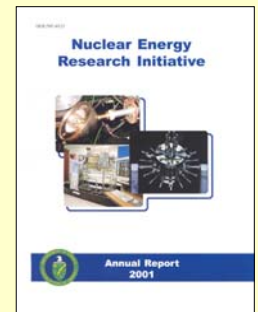
Nuclear Energy Research Initiative (NERI)

- ◆ Established in FY 1999 in response to PCAST Panel recommendations
- ◆ Sponsors innovative scientific and engineering R&D to address key issues facing future use of nuclear energy
- ◆ Competitive, peer-reviewed R&D selection process for researcher-initiated proposals



NERI Annual Report

Published annually to document accomplishments of on-going projects



FY 2002 Solicitations

- ◆ Proliferation-resistant reactor and fuel cycles
- ◆ Advanced reactor systems
- ◆ Hydrogen production from nuclear reactors
- ◆ Fundamental nuclear science



International NERI

- ◆ Established in FY 2001 in response to PCAST Panel recommendations
- ◆ Sponsors bilateral nuclear energy R&D on cost-shared basis
- ◆ Competitive, peer-reviewed R&D selection process



U.S./France
FY 2002



| | |
|-----|--------|
| DOE | \$2.1M |
| CEA | \$2.1M |



U.S./Korea
FY 2002



| | |
|------|--------|
| DOE | \$2.5M |
| MOST | \$2.5M |

- ◆ I-NERI agreements in place with France and Korea
- ◆ Research underway on advanced light water, gas, and sodium reactors
- ◆ Working to add two new I-NERI agreements in FY 2002 -- possibly United Kingdom, South Africa or Japan



Nuclear Energy Research Initiative (NERI)

Program Goal: Effectively address the key issues -- economics, proliferation, and waste management -- affecting the future use of nuclear energy by conducting long-term, investigator initiated, peer-reviewed R&D.

Budget Summary

\$ in millions

| <u>Program Element</u> | <u>FY 2002</u> | <u>FY 2003</u> |
|------------------------|----------------|----------------|
| NERI | 23.4 | 16.1 |
| I-NERI | 7.8 | 8.3 |
| SBIR | <u>0.8</u> | <u>0.6</u> |
| Total | \$ 32.0 | \$ 25.0 |

FY 2003 Planned Accomplishments

- Complete 10 NERI R&D projects initiated in FY 2000.
- Continue 13 R&D projects initiated in FY 2001 and approximately 16 projects initiated in FY 2002.
- Continue bilateral research projects initiated in FY 2001 and FY 2002.



Can We Build New U.S. Reactors By 2010?

Yes!

Can Be Deployed by 2010

- ABWR (General Electric)

Probably Can Be Deployed by 2010

- AP600 (Westinghouse)
- AP1000 (Westinghouse)
- PBMR (Exelon)

Possibly Can Be Deployed by 2010

- SWR-1000 (Framatome)
- ESBWR (General Electric)
- GT-MHR (General Atomics)

Cannot Be Deployed by 2010

- IRIS (Westinghouse)

2010

Conclusions of the Expert Study: *A Roadmap to Deploy New Nuclear Power Plants in the United States by 2010*





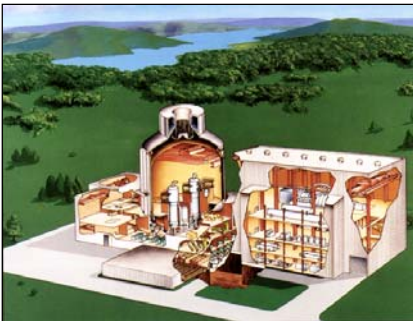
But More Work Must Be Done

Early Site Permit Application



- Complete DOE/Industry Scoping Studies
- Launch Cooperative Demonstration of ESP process

Design Certification and Completion of Detailed Design & Engineering



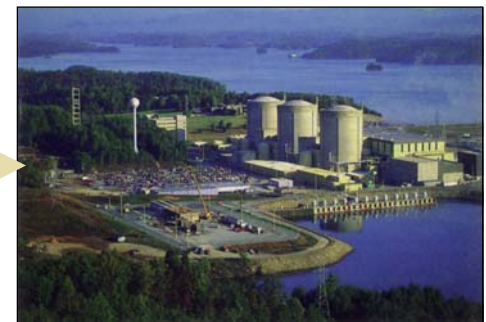
- R&D on First-of-a-Kind Engineering
- Material, Component, and Fuel Testing

Combined Construction and Operating License Application



- Conduct DOE/Industry cost-shared demonstration

Advanced Nuclear Power Systems Online by 2010



- ALWRs
- Gas-cooled reactors

For new U.S. Nuclear Power Plants to be a reality by 2010, DOE must support key R&D and assist industry to demonstrate unproven NRC processes



Nuclear Energy Technologies: Nuclear Power 2010

Pursuing the Deployment of New Plants

Program Goal: Apply competitive, cost-shared cooperation with utility industry to successfully address the regulatory, technical, and institutional issues to enable one or more orders for new, commercial nuclear power plants in the United States by 2005 for deployment by 2010.

Budget Summary

\$ in millions

| <u>Program Element</u> | <u>FY 2002</u> | <u>FY 2003</u> |
|------------------------|----------------|----------------|
| Nuclear Power 2010 | 8.0 | 38.5 |
| Gen IV Initiative | <u>4.0</u> | <u>8.0</u> |
| Total | \$ 12.0 | \$ 46.5 |

FY 2003 Planned Accomplishments

- Assemble the fuel irradiation test fixtures and initiate the advanced gas-cooled reactor fuel irradiation at the INEEL Advanced Test Reactor as the next phase of the advanced gas reactor fuel qualification activities.
- Continue cooperation with the NRC on the development of the regulatory and licensing framework by providing resolution methods for the technical issues affecting licensing.
- Continue the cost-shared Early Site Permit demonstration projects initiated in FY 2002.



Generation IV - An International Initiative

DOE is leading the Generation IV International Forum

- Formal, chartered organization of Governments
- Developing GEN IV Technology Roadmap
- Conduct collaborative nuclear R&D to leverage U.S. Funding



The Generation IV Technology Roadmap will:

- Identify 6 to 8 most promising technologies
- Establish clear R&D plans
- Enable deployment of GEN IV systems after 2010 but before 2030



U.S.A.



United Kingdom



Switzerland



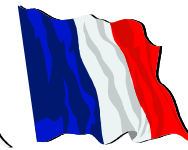
South Korea



South Africa



Japan



France



Canada



Brazil



Argentina



Nuclear Energy Technologies: Generation IV

Long Term Solutions to Nuclear Energy Challenges

Program Goal: Develop, in close cooperation with the international community and industry, next-generation nuclear energy systems which represent significant improvements in all aspects of nuclear power technology.

Budget Summary

\$ in millions

| <u>Program Element</u> | <u>FY 2002</u> | <u>FY 2003</u> |
|------------------------|----------------|----------------|
| Nuclear Power 2010 | 8.0 | 38.5 |
| Gen IV Initiative | <u>4.0</u> | <u>8.0</u> |
| Total | \$ 12.0 | \$ 46.5 |

FY 2003 Planned Accomplishments

- Establish broad international agreement on R&D plans to develop next-generation nuclear power plants.
- Issue the Generation IV Technology Roadmap in Spring 2003.



Advanced Nuclear Medicine Initiative

Program Goal: Support advanced medical research in order to develop an isotope-based treatment to address all forms of cancer by the end of the decade.

Budget Summary

\$ in millions

| <u>Program Element</u> | <u>FY 2002</u> | <u>FY 2003</u> |
|------------------------|----------------|----------------|
| ANMI | <u>2.5</u> | <u>0.0</u> |
| Total | \$ 2.5 | \$ 0.0 |

FY 2003 Planned Accomplishments

- There are no funds requested in FY 2003 to support ANMI.



Fast Flux Test Facility (FFTF)

Budget Summary

\$ in millions

| <u>Program Element</u> | <u>FY 2002</u> | <u>FY 2003</u> |
|-------------------------------------|----------------|----------------|
| Safety and Environmental Compliance | 34.6 | 33.4 |
| Training and Qualification Support | 0.0 | 0.3 |
| Fuel Handling and Washing | 1.8 | 2.0 |
| Sodium Draining and Storage | <u>0.0</u> | <u>0.4</u> |
| Total | \$ 36.4 | \$ 36.1 |

FY 2003 Planned Accomplishments

- Achieve a reduction in surveillance and maintenance costs in accordance with the revised *FFTF Project Management Plan* (to be issued in FY 2002) and resource-loaded project schedule.
- Reestablish hot-cell capabilities, complete validation of fuel handling control system software, and achieve a fuel handling system state of sufficient readiness which would permit initiation of fuel handling operations in FY 2004.
- Complete updates to the sodium drain controls and restoration of the Sodium Storage Facility in FY 2003.



Radiological Facilities Management

Budget Summary

\$ in millions

| <u>Program Element</u> | <u>FY 2002</u> | <u>FY 2003</u> |
|------------------------|----------------|----------------|
| INEEL | 10.7 | 11.2 |
| ANL-W | 32.8 | 31.6 |
| Mound Site | 10.1 | 10.4 |
| LANL | 14.9 | 15.3 |
| ORNL | 11.1 | 10.5 |
| SNL | 1.7 | 1.8 |
| BNL | 1.8 | 1.8 |
| Other Activities | <u>3.6</u> | <u>0.4</u> |
| Total | \$ 86.7 | \$ 83.0 |

FY 2003 Planned Accomplishments

- Continue necessary maintenance and repair on TRA buildings, structures, and utility systems and reduce the growing backlog of maintenance. *(INEEL)*
- Continue construction phase of TRA fire and life safety improvements LICP and TRA electrical utility upgrade LICP. *(INEEL)*
- Maintain essential facilities, safely and securely manage all special materials, dispose of legacy materials, and deactivate unneeded facilities. *(ANL-W)*
- Maintain and operate facilities to conduct heat source and power system assembly and testing of radioisotope power systems. *(Mound Site)*



Radiological Facilities Management *(continued)*

FY 2003 Planned Accomplishments

- Maintain and operate dedicated Pu-238 processing, encapsulation, and scrap recovery facilities. *(LANL)*
- Complete construction of the Isotope Production Facility. *(LANL)*
- Maintain TA-48 hot cell, building RC-1 in a safe and environmentally compliant condition and state of readiness for the production, packaging and shipment of radioisotopes. *(LANL)*
- Maintain unique infrastructure and capability to fabricate irridium cladding and carbon insulators used in radioisotope power systems. *(ORNL)*
- Maintain domestic option to produce Pu-238. *(ORNL)*
- Maintain building 3047 hot cells and building 9204-3 in a safe and environmentally compliant condition and state of readiness for the production, packaging and shipment of radioisotopes. *(ORNL)*
- Continue calutron shutdown activities in building 9204-3, including radiological surveying and characterization and removal of unattached contaminated items. *(ORNL)*
- Support operations of the ACRR in a safe and environmentally compliant condition and state of readiness and maintain the associated hot cells in a non-nuclear standby status. *(SNL)*
- Maintain building 931 and Hot cell building 801 in a safe and environmentally compliant condition and state of readiness for the production of radioisotopes. *(BNL)*



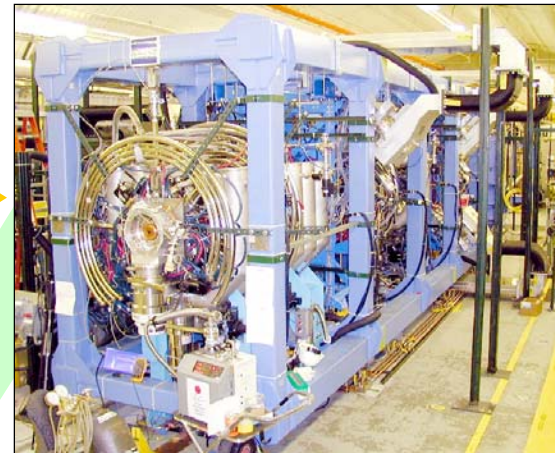
Advanced Technology to Deal With Nuclear Waste

Pyroprocessing



- Advanced, proliferation-resistant recycling and partitioning of spent fuel

Transmutation



- Burning waste components in advanced reactors
- Transmuting what's left with accelerators -- all actinides removed

Goals

- **High-level waste volume reduced by over 90 percent**
- **Repository containment required for only about 300 years instead of 10,000**
- **Energy value obtained from spent fuel without increased proliferation risk**



Spent Fuel Pyroprocessing and Transmutation

Program Goal: Develop and demonstrate an advanced, proliferation-resistance technology to reduce the quantity and toxicity of U.S. commercial spent nuclear fuel while simultaneously enabling the U.S. to vastly increase the efficient use of its nuclear fuel resources.

Budget Summary

\$ in millions

| <u>Program Element</u> | <u>FY 2002</u> | <u>FY 2003</u> |
|------------------------------|-------------------|----------------|
| EBR-II Shutdown | 4.2 ¹ | 0.0 |
| Spent Fuel Treatment | 15.4 ¹ | 15.4 |
| Disposition Legacy Materials | 0.4 ¹ | 0.0 |
| Spent Fuel Pyroprocessing | | |
| R&D | 7.2 ¹ | 2.8 |
| Transmutation Systems | | |
| Development | 43.4 ² | 0.0 |
| Transmutation Science | | |
| Education | 6.6 ² | 0.0 |
| Use of Prior Year Balances | <u>(0.8)</u> | <u>0.0</u> |
| Total | \$ 76.4 | \$ 18.2 |

FY 2003 Planned Accomplishments

- Treat a minimum of 0.5 metric tons of heavy metal of EBR-II spent nuclear fuels.
- Initiate laboratory-scale demonstration of pyroprocessing technology.
- Begin testing of advanced transmutation non-fertile fuel.

¹Funded under Nuclear Facilities Management.

²Funded under Advanced Accelerator Applications.



Program Direction

Budget Summary

\$ in millions

| <u>Program Element</u> | <u>FY 2002</u> | <u>FY 2003</u> |
|------------------------|----------------|----------------|
| Program Direction | <u>23.9</u> | <u>24.3</u> |
| Total | \$ 23.9 | \$ 24.3 |

- FY 2003 budget supports 112 personnel at Headquarters.
- NE supports 36 field staff:
 - Chicago Operations Office (9)
 - Idaho Operations Office (11)
 - Oakland Operations Office (2)
 - Oak Ridge Operations Office (8)
 - Richland Operations Office (6).
- Reduced funding for support services by 32 percent from the FY 2001 level.
- Supports Nuclear Energy Research Advisory Committee activities.
- Supports Nuclear Fuel Cycle policy and economic analysis.